# MECH 490 Mechanical Engineering Research Projects

Spring 2022

**Instructor**: Professor P. Rodi, (Patrick.Rodi@rice.edu), GRB W200F
**Class Hours**: (weekly meetings), day and times are TBD, on-line (for now)
**Office Hours**: Monday/Wednesday/Friday, 4:00pm - 4:45pm, or by appointment
**Course URL:** https://canvas.rice.edu/courses/46646

**Course Outcomes Expected**:
Students completing the course should be able to:

1. Identify, locate, acquire, and digest information in the historical literature pertinent to the research topic under investigation.

2. Understand the context of the research being conducted. Understand exactly what research question(s) are being asked. Be able to determine what specific data/etc. would be required to address these questions.

3. Plan a research program directed to address the research question(s) from step 2, while respecting any financial, temporal, physical or any other relevant constraints.

4. Conduct guided research, under direction of the professor, to execute the research program defined in step 3, and to acquire the desired data.

5. Prepare research documentation and deliverables, such as reports, presentations, software, hardware, etc. as required. Archiving the work.

**Textbooks**: (none required)
1. Supplementary material from *Introduction to Flight* by John D. Anderson Jr., McGraw-Hill Education.
2. Provided notes and reports.

**Grading**: 50% Semester Report
20% Semester Presentation
30% Comprehensive Final Examination

**Homework**: Issued infrequently, but not required or graded. Solutions will be posted.

**Exams**: Comprehensive Final Examination

**Please note for Exams**:
1. Points will be deducted in your exam if your submission is not clear in logic and presentation.
2. All quantities must have the correct dimensions.
3. All answers must be clearly marked (e.g., boxed or underlined).

**Distribution**: Engineering science, 1-4 credits. Independent investigation of a specific topic or problem in mechanical engineering. Research under the direction of a selected faculty member.

**ADA Notice**: Any student with a disability requiring accommodations in this course is encouraged to contact the instructor after class or during office hours. Additionally, students should contact Disability Support Services in the Ley Student Center.

# Syllabus

1. Introduction & Background
Class syllabus. Logistics, coordination, etc. Some basics on aerodynamics, incompressible vs. compressible flow, transonic drag, and area ruling. What are we doing? Why it is important? What conclusions do we hope to make?

2. The Role of Historical Literature
Why history and context are important. Where to find such literature. What is relevant and what is not. How to acquire reports (often easier said than done).

3. Understanding the Problem and Scope
Looking deeper beyond "What are we doing?" and "Why it is important?" to the details of what work will actually need to be performed. The effort could involve models generated, data acquired, software coded, etc.

4. Developing a Research Program
Creating a research plan to perform the work that can be performed within the constraints provided. Creating a research schedule with inchstones, milestones, and scheduled deliveries. Address constraints such as resource availability, phasing of work with other activities, generating the specific deliverables, etc. Identify critical path(s). Who wins the "Budget" vs. "Schedule" battle? Commonly used tools such as Gnatt charts.

5. Conducting the Research
Executing the plan. Tracking your progress. Adjusting the work pace. Understanding what the data are saying. Spotting problems. Redirection, if required. Recovery plan(s), if needed. When to say "stop."

6. Documentation, Deliverables, and Archiving
Writing a technical document. Preparing a technical presentation. Meeting milestones and producing deliverables. Archiving of processes, tools, models, raw data, reduced data, data analyses, results and conclusions, resources consumed, lessons learned, ideas for follow-on work, etc.